Control device

FIELD OF THE INVENTION

The present invention relates to a control device, and relates particularly but not exclusively to a pointing device for a computer or other electronic device. The invention also relates to a laptop computer.

BACKGROUND OF THE INVENTION

Originally trackballs were commonly used in laptop computers, but they were large, prone to clogging and required frequent cleaning. Hence they are now rarely seen.

Laptop computers currently almost all use one of two pointer control devices: a "pointing stick"/"nib" (typically a small button which is pressed with one finger eg as disclosed in EP 685,817A and EP 663,648A), or a touchpad. Each device allows the position of the on-screen pointer (typically a small arrow) to be controlled in two dimensions using fingertip movements. The touchpad is becoming more common and is generally perceived as easier to use, although both are generally considered to be considerably less easy to use than the mouse that is used with desktop computers. However accurate control of the cursor is difficult with both the above devices. Hence, it is quite common for users to plug a conventional mouse into a laptop computer, when one is available.

JP 2000081946 discloses a mouse having, instead of the conventional roller ball, an "operation rod" projecting downwardly from its lower surface which engages a surface of eg a mouse mat or the like so that movement of the mouse tilts the rod. The inclination of the rod is detected and the resulting signal is input to a computer through a conventional lead.

US 5,790,108 discloses a pointing device for a computer comprising a handle somewhat similar to the shell of a conventional mouse mounted on a gantry for horizontal sliding motion in the x and y directions. The assembly carries two coils which are magnetically coupled to fixed magnets and carry feedback currents derived from a computer whose cursor is controlled by the mouse. These currents are used to constrain the motion of the device and hence the cursor in various ways, including movement along a straight edge and guiding the cursor to menus and other graphic control elements of the display. In one embodiment the device comprises a stack of the above components and in another embodiment the device is in the form of a joystick.

Neither embodiment could be regarded as a low profile device.

Many other kinds of equipment use other devices to allow a user to select functions and provide other kinds of control inputs. For example, buttons, keys, knobs or rotating wheels may be used.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

It is an object of the present invention to provide a low profile control device which is suitable for incorporation in a laptop computer. By "low profile" is meant a profile which is sufficiently low to enable the control device to be accommodated in the thickness of a base portion of a clamshell design laptop computer.

It is a further object of the present invention to provide a low profile control device for a computer (not necessarily a laptop computer) which alleviates at least some of the problems encountered in prior art control devices.

A further object of the invention is to provide a control device for a laptop computer which has at least some characteristics of a mouse as used for controlling a desktop computer.

In one aspect the invention provides a low-profile control device for a computer, the control device comprising a fixed mounting and a control member connected to the fixed mounting by a connecting means. The control member is acted upon by two or more spaced-apart fingertips of a user, and travel of the control member is restricted in a predetermined plane. An output means is coupled to said control member for generating a vector output signal in response to a force applied by the user in the predetermined plane.

In the present specification, the words "fingers" and "fingertips" are used throughout to include thumb and thumbtip, as appropriate. The term "vector output signal" is to be construed to include discrete components (eg x and y components) of such a signal.

Preferably a wrist-rest surface is disposed substantially parallel to the plane of travel (normally the horizontal plane) of the control member.

In one embodiment the control member has an upper surface substantially flush with the wrist-rest surface.

In another embodiment the control member has an upper surface recessed with respect to the wrist-rest surface.

Preferably the control member is substantially oval in plan view.

Preferably the travel between extreme positions in said plane is constrained to be 50mm or less, more preferably 30mm or less, desirably 10mm or less.

Preferably the device comprises means for restricting travel of the control member in said plane to 50mm or less.

In one embodiment the control device comprises means for substantially preventing movement of the control member in said plane. Accordingly, in this embodiment the control member feels substantially stationary in use.

In one embodiment the device is in the form of a platform but with a shallow edge of 1-5mm in height all or part of the way around. The fingertips grip the edge and combine to gently push on it in the required direction. It has been found that the sensitivity of one's fingertips is such that two or more fingertips can accurately apply a desired force in a desired direction by gripping the shallow edge and that a surface with a shallow edge can be gripped and used in a way similar to the way fingers are used to push a desktop mouse.

In another embodiment the device is in the form of a flat platform, on the surface of which the fingertips rest in similar relative positions as when gripping a conventional computer mouse, gently pushing on the surface in the required direction. It has been found that two or more fingertips can apply a desired force in a desired direction onto a surface at least as well as a single fingertip can.

In such embodiments the device can be used as an input device for laptops that feels considerably more similar to a desktop mouse than conventional solutions (e.g. touchpads or pointing sticks). It exploits the fact that a great deal of control and feedback can be experienced just by fingertips.

Preferably the transducer arrangement comprises two transducers arranged to sense orthogonal components of force in said plane and to generate vector output signal components.

In another aspect the invention provides a laptop computer having a wrist-rest surface and a pointing device located in the wrist-rest surface, the pointing device comprising a fixed mounting disposed beneath the wrist-rest surface and a control member located on the fixed mounting. The control member responds to transverse forces generally parallel to the wrist-rest surface applied by two or more spaced-apart fingertips of a user, and an output means is coupled to the control member for generating a vector output signal in response to these transverse forces.

In one embodiment the control device is responsive to the duration of the force applied to it by the user.

In another embodiment the control device is arranged to generate individual outputs responsive to forces applied by different fingertips of the user during use.

In another embodiment the control device is arranged in use to generate a further output signal in response to a torque applied by the user in said plane.

In another embodiment the control device is arranged to rotate in response to a torque applied by the user in said plane.

In another embodiment the control device is responsive to a force orthogonal to said plane applied by fingertips of a user to at least one control surface of the device to generate a corresponding further output signal.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention will be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a plan view of a laptop computer incorporating a control device in accordance with the invention;

Figure 2 is a partial perspective view taken on Figure 1 and partially cut away to show the mounting and transducer arrangement of the device;

Figure 3 is a perspective view showing how the control device is typically held with the fingertips;

Figure 4 is a perspective view similar to that of Figure 3 but showing a further embodiment, and

Figure 5 is a schematic block diagram showing the cursor control circuitry of the laptop of Figure 1.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figure 1, a laptop computer L of is shown from above with the screen 4 opened to reveal the keyboard region 6 and wrist-rest area 5 of the base portion of the

laptop. The base portion and lid portion (carrying the screen on its interior) are hinged in conventional fashion at the base of the screen in a standard clamshell configuration.

In accordance with the invention the laptop is provided with the control device comprising a shallow control member or platform 1 which is located in a shallow recess or well 7 in the wrist rest area 5.

Referring to Figures 1 and 2, the platform 1 is fixedly mounted on a post 10 which in turn is mounted for rotation about a vertical axis A in a support block 11. Support block 11 is connected to conventional force sensors 13 and 14 which are in turn fixedly located on supports 15 which extend upwardly from the floor of the base portion beneath wrist-rest area 5. Sensors 13 and 14 sense the x and y components of force applied to the device by the fingertips of a user and transmitted by block 11 and generate corresponding output signals which control the movement of a cursor 9 on the screen 4. The translation of the post 10 in the x and y directions is resiliently constrained by these sensors (or other coupling) such that translation of the platform 1 is so small as to be imperceptible to the user. It is assumed that the force sensors 13 and 14 have little or no resistance to shear forces but if necessary the supports 15 can be made resilient to allow for some shearing stress of sensor 14 when sensor 13 is being compressed and vice versa. The selection of sensors 13 and 14 is well within the capabilities of persons skilled in the art; they can for example be thick film strain gauges as disclosed in EP 663,648A whose entire contents are incorporated herein by reference.

The device can easily be accommodated in a base portion of a conventional clamshell design of case, the base portion having a thickness T of eg 10 to 25 mm as shown.

The platform 1 is generally oval in plan view and has conventional left and right mouse buttons 2 and 3 near the forward portion of its periphery. In a variant suitable for use with an Apple Macintosh computer, a single mouse button can be substituted for these

buttons or the entire platform could be responsive to pressure to output the necessary switching signal.

The platform 1 is free to rotate about axis A as indicated by arrow A1 (Figure 2), so that left - or right-handers can rotate it to a comfortable angle, then leave it there. Figure 1 shows it positioned for a right-hander.

As shown in Figure 3, a user typically positions his or her index finger 16 and second finger 17 over the buttons 2 and 3, as with a desktop mouse, and uses their thumb tip and remaining two fingertips to grip the side 8 of the platform. As the user tries to push the platform, the device registers the overall force applied (i.e. direction and strength) using conventional sensors as mentioned above. This is converted to a pointer movement on the screen.

The height h of sidewall 8 is preferably 1 to 5 mm, and is the same as or slightly less than the depth of the depression 7. Hence, rather than protruding, the platform 1 is sunk into the depression such that its upper control surface is flush with or slightly below the level of the wristrest area 5.

As shown in Figure 3, the sunken area around the platform provides room for the fingertips (namely the tip of thumb 18 and ring finger 19 and little finger 20) to grip it, and the device itself does not impede typing on the keyboard 6 or closing the laptop lid. Index finger 16 and middle finger 17 are spaced apart and rest on buttons 2 and 3 respectively.

In the embodiment of Figure 4 the depression 7 is dispensed with and the platform 1' is in the form of a flat plate whose upper control surface is flush with the surface of wrist rest area 5 and is provided with pressure-sensitive switching regions 2' and 3' which function as mouse buttons and provide switching outputs for controlling graphic

elements (eg selecting menu items) on display 4. Again the platform can be freely rotated about axis A, and is shown positioned for a right-hander.

In other embodiments, limited translational movement of the platform 1 of say + or - 10mm may be allowed, and sensors arranged to measure movement, duration of applied force or other quantities may be used in place of or in addition to the force sensors.

Figure 5 shows a block diagram showing the connection of the x and y force transducers 13 and 14 to the circuitry of a computer. In this diagram the force transducers produce analog signals for the x and y force components. These signals are fed via a multiplexer 23 to an analog-to-digital converter 22, which then sends a digital signal to the central processing unit (CPU) 21 of the computer. The CPU has a control output connected to a control input of multiplexer 23. The CPU has an output via conventional driver circuitry (not shown) to display 4 (Figure 1) which controls the position of the cursor. Switching outputs from the buttons 2/2' and 3/3' are processed in conventional fashion, not shown.